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ABSTRACT

This paper addresses the issue of effectively integrating technology such as the World Wide Web and computer software technology into diverse classrooms. Significant ideas and support for constructivist, project-based teaching and learning approaches are also provided. This paper argues for schools, universities, and departments of education across the nation to lead the way in preparing tomorrow's classroom teachers for incorporating technology into their teaching. The paper is organized around the national goals of the Technology Literacy Challenge, which include equipping all classrooms with modern computers, connecting all classrooms to the Internet, developing interactive software and networked learning content to help all students meet high standards, and preparing all teachers to integrate new technologies into the curriculum. Contains 20 references. (DDR)

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Effectively integrating the World Wide Web and computer software technology into diverse classrooms

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Abstract

Effectively integrating the World Wide Web and computer software technology into diverse classrooms

On February 15, 1996, President Clinton and Vice President Gore issued a challenge to American educators, business, and community leaders: prepare students to become technologically literate by the 21st century (*Technology Challenge*, 1996). The Technology Literacy Challenge has four concrete goals:

- equipping all classrooms with modern computers;
- connecting all classrooms to the Internet;
- developing interactive software and networked learning content to help all students meet high standards, and
- preparing all teachers to integrate new technologies into the curriculum.

This paper addresses effectively integrating technology, such as the World Wide Web and computer software technology, into diverse classrooms. It also provides significant ideas and support for constructivist, project-based teaching and learning approaches. It is critical that schools, universities, and departments of education throughout the nation lead the way in preparing tomorrow's classroom teachers for incorporating technology into their teaching.

Effectively integrating the World Wide Web and computer software technology into diverse classrooms

On February 15, 1996, President Clinton and Vice President Gore issued a challenge to American educators, business and community leaders: prepare students to become technologically literate by the 21st century (*Technology Challenge*, 1996; *NetDay 2000 President Clinton*, 1997). The Technology Literacy Challenge has four concrete goals:

- equipping all classrooms with modern computers;
- connecting all classrooms to the Internet;
- developing interactive software and networked learning content to help all students meet high standards, and
- Preparing all teachers to integrate new technologies into the curriculum.

The Secretary of Education's initiative, "Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge - A Report to the Nation on Technology and Education," outlines a plan to meet the President's challenge and implement the Improving America's Schools Act of 1994 - Public Law 103-382 (*Getting America's students ready for the 21st Century, 1996).* State departments of education and colleges of education are working earnestly to implement the President's Technology Literacy Challenge. They are to ensure that children from rural, suburban, and urban schools have the same access to the same universe of knowledge (*Memorandum for the heads of executive departments*, 1997; *The technology literacy challenge, 1996).*

In 1995, the Office of Technology Assessment's (OTA) study, Teachers and Technology; Making the Connection, concluded that "helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized" (*Technology innovation challenge*, 1997). Additionally, the President's Committee of Advisors on Science and Technology (PCAST) reported in 1997 that "The substantial investment in hardware, infrastructure, software, and content that is recommended by this report will be largely wasted if K-12 teachers are not provided with the preparation and support they will need to effectively integrate information technology into their teaching" (*Technology innovation challenge*, 1997, p. 2). Moreover, educational leaders concede that the lack of teacher preparation and professional development in the use of educational technology is a critical factor that limits the benefits of technology for student learning (Clement, 1994).

With all the hoopla regarding computer technology, effective educators ask, "If technology is the answer, what is the question? (Eisenberg & Berkowitz, 1997)" Computer technology should not be seen as the panacea to solve all of America's education problems (Orlich, 1998). If American educators are to connect every classroom and library to the Internet by the year 2000, then teachers must be as comfortable with a computer as they are with a chalkboard (*Technology Challenge*, 1996). Preservice and

inservice teachers must receive instruction in "computer literacy and usage" and shown how to employ technology in their teaching. Moreover, various learning theories must be used to properly engage student learning and is needed in order for teachers to effectively implement technology within educational curricula and learning environments (Orlich, 1998).

This paper addresses effectively integrating technology, such as the World Wide Web and computer software technology, into diverse classrooms. It also provides significant ideas and support for constructivist, project-based teaching and learning approaches. It is critical that schools, universities, and departments of education throughout the nation lead the way in preparing tomorrow's classroom teachers for incorporating technology into their teaching (Roblyer, Edwards, & Havriluk, 1997).

A new paradigm for teachers

The constructivist perspective of cognitive psychology proposes that students must be actively involved in meaningful tasks or projects in order for learning to occur (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Once a commitment is made to structuring the classroom's activities around engaging projects, nearly every other aspect of pedagogy must change as well (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). The Goals 2000 Educational Technology: Tools for Transforming Teaching and Learning, Ohio's SchoolNet Professional Development Matrices, and other technology initiatives support and contain ideas for assisting teachers in assisting students in becoming computer literate (Archer, 1998; Trotter, 1998). There are a number of lessons for technology-supported educational reform efforts ("Ethnic divide," 1998; *Technology and Education Reform*, 1995):

- Time must be devoted to developing a school wide vision, a consensus around instructional goals, and a shared philosophy concerning the kinds of technology - supported activities that would support those goals (*Technology and Education Reform*, 1995). Site-based management and grant opportunities can serve as catalysts for such discussions.
- Adequate technology access is needed for all students (*About SchoolNet*, 1997; Harris, 1996; *Telecomputing for Teaching and Learning*, 1994). To the extent that there are only a few computers in regular classrooms, or computers are clustered in a few labs in one part of the school, most teachers have little opportunity, and indeed feel little responsibility for, integrating technology into their instruction (*Technology and Education Reform*, 1995). Therefore, a classroom needs roughly one computer for every four students if students are to have the kind of access they need to engage in significant technology-supported projects (*Technology and Education Reform*, 1995).
- Teachers need time to learn to use technology and to incorporate it into their own curricular goals (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Particularly after the initial hurdles, learning to use a new piece of hardware or software in a mechanical sense is a fairly short-term activity. Thinking about how technology can support one's own instructional goals, however, and learning how to orchestrate a

class in which students are doing challenging projects, portions of which are technology based, take much longer (*Technology and Education Reform*, 1995). It is this latter training that is all too often missing from technology implementation efforts. This learning needs to occur over time, preferably with opportunities to observe models, to practice, and to receive feedback in one's actions.

- Easily accessible technical support is critical (Burns, Roe & Ross, 1999). Most teachers have limited technology experience. Even if they are comfortable with using a technology they have not completely mastered, these teachers will not use it if there is a chance they will encounter technical problems (*Technology and Education Reform*, 1995). More teachers will incorporate technology into their teaching if on-site technical assistance is readily available.
- The system should provide rewards and recognition for exemplary technology-supported activities (*Technology and Education Reform*, 1995). Like the rest of us, teachers are influenced by the reward structure when it comes to deciding where to place their energies. Not surprisingly, school leadership that values technology and education reform activities is associated with more widespread and sustained emphasis in these areas.
- Good curricular content must come first (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Although in some cases the availability of new technology may inspire projects, it is critical that strong curriculum contents drive the design of the technology - supported activities (Trotter, 1998). For some teachers, there will be a temptation to assign projects that use an exciting new technology but have little curricular value. Teachers should began planning with educational needs and instructional goals (*Technology and Education Reform*, 1995). These can provide the discipline to keep technology-supported projects "on track."
- The projects should provide opportunities for teachers to collaborate with their peers (*Technology and Education Reform*, 1995). The most ambitious and successful technology-supported projects typically are planned and executed by teacher teams (Archer, 1998;*Technology and Education Reform*, 1995). All of the well-known advantages of teamwork, such as multiple sources of inspiration, expertise, and energy, apply to the difficult job of having a student- centered classroom. When teachers work together, there are more far-reaching and ambitious activities than when they work in isolation.
- Technology should be used across the disciplines and classrooms (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). There is a certain amount of "overhead" that goes with learning to use any new technology. Students will need to acquire keyboarding skills (*About SchoolNet*, 1997; *Telecomputing for Teaching and Learning*, 1994). They will also need to learn how to get into programs, files, and how to store their work in appropriate ways. Moreover, when technology is used across a broad range of classes, many more students will find enjoyable uses for the new technology and computer programs and capital is used more expediently (Burns, Roe & Ross, 1999). This can lead to them becoming confident about their learning abilities.

How can technology be effectively integrated into diverse classrooms?

Educational reform calls for a shifting away from the traditional method of organizing instruction in lecture format or practicing discrete skills in specific academic disciplines toward an emphasis on engaging students in long-term, meaningful projects (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). It has been documented that technology can enhance student acquisition of discrete skills through various computer applications such as drill and practice, problem solving, application, and simulation (Burns, Roe & Ross, 1999).

Knowing that projects with real-world relevance must be multifaceted, teachers can incorporate both higher-order skills, such as design, composition, and analysis of lessons with technology, along with the more basic skills, such as the mechanics of writing of lesson planning (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Since schools primarily focus on verbal/linguistic intelligence and somewhat on logical/mathematical, educators can use Howard Gardner's Multiple Intelligences to engage diverse student groups in learning (Orlich, 1998). In most cases, the other intelligence levels and learning styles are ignored. In order to include other intelligences, educators must plan activities that promote a variety of learning experiences for all students (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Computer and other advanced technology can be effective media for assisting future and in-service teachers in employing a variety of teaching strategies to reach the school populace. Gardner's multiple intelligences are (Orlich, 1998):

- Verbal/Linguistic
- Logical/Mathematical
- Visual/Spatial
- Body/Kinesthetic
- Interpersonal
- Intrapersonal
- Musical/Rhythmic
- Naturalist

The following table provides examples of how technology can be used to assist preservice, novice, and veteran teachers in using a variety of teaching methods and the multiple intelligences to engage students in learning (Orlich, 1998, p 130).

Table 1

	Description & Learning Style	MI Toolbox of Teaching Strategies	Multiple Intelligence Technology
Verbal / Linguistic	■ This intelligence involves the use of language and words, whether written or spoken. ■ This type of learner likes to play with words in reading, writing, and speaking.	■ Reading, Vocabulary ■ Formal Speech ■ Journal/Diary keeping ■ Creative Writing ■ Poetry, Debate ■ Impromptu Speaking ■ Humor/Jokes, Storytelling	■ Microsoft Word for journal, story & report writing ■ Clip Art to illustrate stories ■ Living Books ■ Books on Audio tape ■ World Wide Web (WWW) surfing, sending e-mail & contributing to newsgroups ■ PowerPoint to create presentations & storytelling

Logical/ Mathematical	■ **This intelligence uses numbers, sequencing, and patterns to solve problems.** ■ **This type of learner likes to experiment with and explore numbers and patterns.**	■ **MI Toolbox of Teaching Strategies** ■ **Abstract Symbols/Formulas, Outlining** ■ **Graphic Organizers** ■ **Number Sequences, Calculation** ■ **Deciphering Codes** ■ **Showing Relationship** ■ **Syllogisms, Problem Solving** ■ **Pattern games**	■ **HyperStudio presentations for problem solving** ■ **Jasper setting for "natural setting" problem solving** ■ **Math Munchers, Math Blasters or Math Workshops** ■ **Mimeograph copier to create ditios for math skill building** ■ **Charts & graphs using PowerPoint**
Visual/ Spatial	■ This intelligence pertains to the use of shape, color, and form and the relationships among objects. ■ This type of learner likes to put his or her visualizations into drawing, building, designing, and creating.	■ Guided imagery ■ Active imagination ■ Color schemes, Patterns/designs ■ Painting, Drawing ■ Mind mapping ■ Pretending, Sculpture ■ Pictures	■ KidPix Studio Deluxe to create cards, calendars, banners ■ Laser Disc ■ Digital camera for taking pictures for Bulletin Boards ■ Print Shop Deluxe to create cards and other visuals ■ Vacuform creations for adding dimensions to any lesson ■ Overhead transparencies
Body/ Kinesthetic	■ This intelligence uses the body for self-expression. Coordination, dexterity, flexibility, and strength are all important in this intelligence. ■ This type of learner likes to move, touch, dance, play sports, do crafts, and learn through movement and touch.	■ Folk/Creative dance ■ Role Playing ■ Physical Gestures, Drama ■ Martial Arts ■ Body language/games ■ Mime, Inventing ■ Sports/games	■ SimCity 2000 for role-playing ■ Microsoft Word to type a readers' theater ■ WWW for learning how to folk/creative dance ■ Video recordngs that cover subjects such as dance, sports, and drama
Interpersonal	■ This intelligence is the ability to deal with other people. It involves one's ability to perceive what another person is thinking and feeling through body language gestures. ■ This type of learner shares, compares, cooperates, has lots of friends, and learns with and from others.	■ Giving Feedback ■ Intuiting others' feelings ■ Cooperative learning ■ Person-to-person communication ■ Empathy practices, Division of labor ■ Collaboration skills, Sensing other's motives ■ Group Projects	■ Simulation found on Laser disc and Computer software can be used to encourage group work, collaboration ■ Students cooperatively grouped to create a video production of a story ■ E-mail for communicating about group work, pen pals
Intrapersonal	■ This type of learner works alone at his or her own pace, producing original, unique work. ■ This intelligence involves a self-knowledge, being able to identify one's own feelings and moods. Self-esteem and self-discipline are both particular to the intrapersonal intelligence.	■ Silent reflection methods ■ Metacognition techniques ■ Emotional processing ■ "Know thyself" procedures ■ Mindfulness Practices ■ Inventing ■ Focusing/concentration skills ■ Higher-order reasoning ■ Complex guided imagery ■ Centering practices	■ Word processing a self reflection assignment ■ Myers-Briggs personality tests ■ Grade Quick and Grade A+ for identifying student's strengths & weaknesses ■ WWW to research student's genealogy ■ The Teacher's Helper Plus for crossword puzzles ■ Creating web site using Html or Page Mill
Musical/Rhythmic	■ This intelligence deals with pitch, tone, and rhythm. ■ This type of learner likes to sing, hum, play instruments, and generally respond to music.	■ Rhythmic patterns ■ Vocal sounds/tones ■ Percussion vibrations ■ Humming ■ Environmental sounds ■ Instrumental sounds ■ Singing	■ Microsoft musical instruments - students can hear all of the different sounds that each instrument makes & where it came from ■ CD-ROM or Laser Disc for sounds or music

		■ Tonal patterns ■ Musical Composition/creation ■ Music performance	■ Computer Audio recorder for voice manipulation and sounds ■ HyperStudio ■ Ellison cuts to represent the rhythmic pattern of a song
Naturalist	■ This intelligence deals with enjoying the environment. ■ This type of learner is good at observing and categorizing plants and animals. Likes to keep notebooks and use telescopes. Good at drawing or photography	■ Field trips ■ Observation techniques ■ Camping ■ Astronomy ■ Environmental and nature sounds ■ Field research	■ Digital Camera - Adobe Photoshop ■ National Geographic Laser Disks ■ Internet - MayaQuest ■ Computer Software - Oregon Trail ■ Clip Art - KidPix ■ Adobe Pagemaker

There is a variety of teaching strategies and multiple intelligence tools teachers can use with their students. If social studies teachers want to develop the naturalist intelligence, Oregon Trail software or the Internet's Maya Quest can be used. Technology, especially the computer, can support preservice and inservice teachers' efforts in teaching in teaching by:

- Students will display greater concern about the quality of their technology-supported work when they present to their classmates (*About SchoolNet*, 1997; *Telecomputing for Teaching and Learning*, 1994).
- Reducing the complexity of computer technology so students are successful and gain skills (*About SchoolNet*, 1997; *Telecomputing for Teaching and Learning*, 1994). Teachers are usually surprised not only by how quickly students learn to use new hardware and software, but also by how much farther they could go into specific subject areas when given technology supports. Technology can automate mundane, repetitive portions of a task and support visualizing and presenting essential, abstract elements.
- Dramatically enhancing student motivation and self - esteem. By using technology, the amount of time the students spend on a task usually increases skills (*About SchoolNet*, 1997; *Telecomputing for Teaching and Learning*, 1994). They are more willing to critically review, revise, and have pride in their finished product. Making obvious the need for longer blocks of time. When students use technology, it becomes clear that time for working on projects need to be extended so that students can get access to their work files. (*About SchoolNet*, 1997; *Telecomputing for Teaching and Learning*, 1994):
- They also can make significant progress, and then store them for future work.
- Creating a multiplicity of roles, leading to student specialization in different aspects of technology use (*Technology and Education Reform*, 1995). Given the ever-changing array of technology capabilities, the students will find a wide range of potential specialties. These can range from creating hypertext links to navigating the Internet to videoediting to computer graphics. Each of these roles is valuable in a complex project, and students who had not excelled in more conventional academic setting often shine in these roles.

- Instigating greater collaboration as students assist peers and sometimes their teachers (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Working side by side on technology-based tasks, students will exhibit a tendency to seek advice and offer it to each other. Teachers can place students into cooperative and collaborative groups. Students will continue to work together on non-technology-based activities.
- Giving teachers additional impetus to become the facilitator and advisor (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). When students are actively engaged with technology, the teacher becomes a roving coach, working with different groups or students. Computer technology can further support the coaching role by providing a readily viewable display of the student's work (Harris, 1996). The student and teacher can then jointly generate, review, and evaluate alternative approaches.

Preparing all teachers to integrate these new technologies into the curriculum

Involvement in technology-based educational legislation can have effects on the teachers. Although technology-supported classroom projects require a great deal of a teacher's own time, as well as great effort, they can pay sizable dividends in terms of a teacher's own professional growth. Examples of this growth include (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997):

- An increase in teachers' technology and pedagogical skills (Burns, Roe & Ross, 1999). In addition to learning about the technologies that are incorporated in their classroom activities, teachers can acquire skills in setting up cooperative work groups, providing individualized coaching, and orchestrating multiple parallel activities within their classrooms.
- Greater collaboration within their own school (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). The introduction of new technologies can give teachers a compelling reason to come together to think about what they want to teach. The technology could support their goals as they learn about new technologies, and plan multidisciplinary technology-supported projects.
- Contact and collaboration with external school reform and research organizations (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Many technology-supported projects can be funded by initiatives such as "Power Up" (Edwards, 1998). Various state organizations such as Ohio SchoolNet will work with classroom teachers in designing and implementing classroom applications of technology skills (*About SchoolNet*, 1997; Edwards, 1998; *Telecomputing for Teaching and Learning*, 1994).
- Involvement in training and professional conferences (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Involvement in technology-related activities can bring many teachers recognition, not only within their schools, but also at state, national, and international conferences.

As challenging as it is to bring a constructivist approach to an individual classroom, there is an equally difficult challenge in implementing a schoolwide reform (Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Central to this challenge is getting all or most of the teachers within a school to buy into a coherent instructional vision and strategies for using technology to support that vision. Additionally, school leadership,

training, allocated time to implement the system, and opportunity for joint decision-making are essential if a common vision of teachers gaining technological success is to emerge (Edwards, 1998; Orlich, 1998; Roblyer, Edwards, & Havriluk, 1997). Warren Wiersbe's (Maxwell, 1996) words ring so true as educator effectively integrate the www and computer software into classrooms:

> We can benefit from change. Anyone who has ever really lived knows that there is not life without growth. When we stop growing we stop living and start existing. But there is no growth without challenge, and there is no challenge without change. Life is a series of changes that create challenges, and if we are to make it, we have to grow. (p. 92)

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